Plaintiffs' Exhibit 29
(Redacted)

IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF VIRGINIA

Alexandria Division

UNITED STATES, et al.,	)	
	)	
Plaintiffs,	)	
v.	)	No. 1:23-cv-00108-LMB-JFA
	)	
GOOGLE LLC,	)	
	)	
Defendant.	)	

DECLARATION OF RAMAMOORTHI RAVI
IN SUPPORT OF PLAINTIFFS' OPPOSITION TO
GOOGLE'S MOTION FOR SUMMARY JUDGMENT

Ramamoorthi Ravi, PhD., being duly cautioned, declares as follows:

1. I am over 21 years old and am competent to testify about the matters in this Declaration based on my personal knowledge.
2. Attached hereto as Exhibit A is a true and correct copy of the December 22, 2023, Expert Report of Ramamoorthi Ravi, PhD, along with associated errata. Attached hereto as Exhibit B is a true and correct copy of the February 13, 2024, Expert Rebuttal Report of Ramamoorthi Ravi, PhD, along with associated errata.
3. I authored the attached Expert Reports identified in Item (2) above and understood at the time I signed them that they were being prepared for use in this litigation. I am prepared to testify at trial, under oath, to the matters set forth in these reports. My statements set forth in these reports, as modified by associated errata, are true and correct to the best of my knowledge.
4. The exhibits attached to the reports described in Item (2) are true and correct copies.

I declare under penalty of perjury that the foregoing statements in this Declaration are true and correct.

Dated: 05/10/2024

Signed: _____

Ramamoorthi Ravi, PhD.

County and State: Allegheny County, Pennsylvania

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA
ALEXANDRIA DIVISION
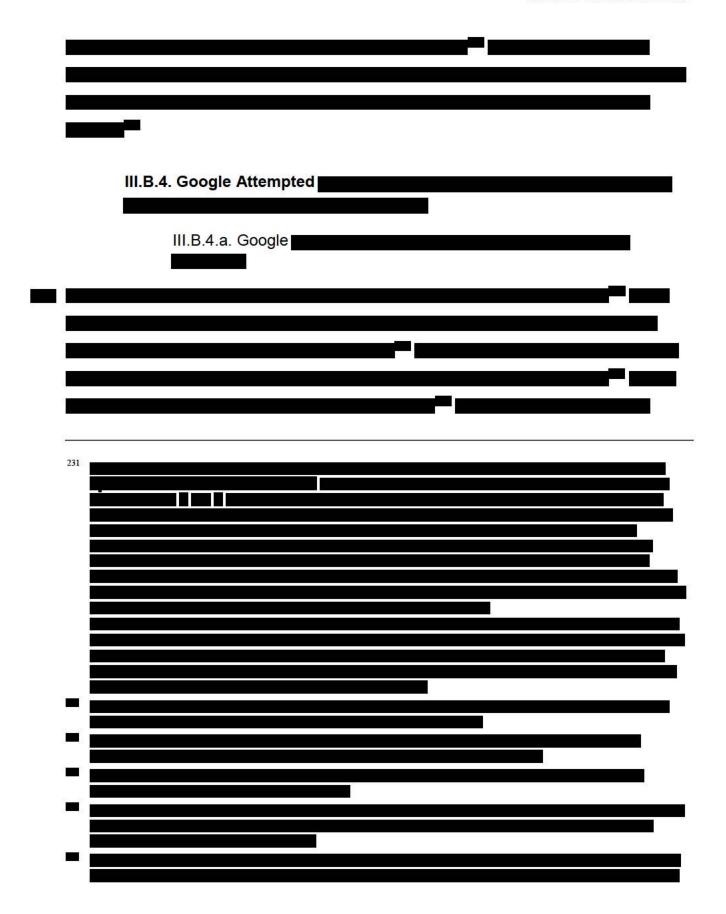
United States of America, *et al.*,

Plaintiffs,

v

Google LLC,

Defendant.

Case No. 1:23-cv-00108

HON. LEONIE H. M. BRINKEMA

EXPERT REPORT OF

RAMAMOORTHI RAVI, PH.D.

DECEMBER 22, 2023

███████████████████████████████ ████████████████

██

███

████████

III.B.4. Google Attempted ████████████████████
████████████████████████

III.B.4.a. Google ███████████████████████
████████

██ ██████████████████████████████████ ████████

███████████████████████████████████████

████████████████████████ ██████████████████

██████████████████████████████ ████████

███████████████████████ ████ █████████████████

231

██
████ ████████████████████████████████████
███ ██ ██ ██ █████████████████████████████
██
███
██
███
██
████████████████████████████████
██
████████████████████████████████████
██ ██
████████████████████████████████
██ ███
████████████████████████████████████
██ ██
███████████████████████████
██ ███
████████████████████████████████████
██ ████████████████████████
██ ███
███

███ ██ █

██

██ █

123.   ██

███

████████████████████████████████████ █ █████████████████

██

███

███████ █ █████████████████████████████████████

███

██████████████████████ █ ████████████████████████

███

███████████████████████████

_____

██
██
██
██████████

██ ██
██
████████████████████████████████████

██ ██
███████████████████████████

██ ██
██
██
██
██
██
██
██
███████████████████████████████████████

██ ██
██
████████████████████

██ ██
██

124. ███
███ █████████████████
███ ████████████████████████
███
███
███ ██ ████████
██
██

██ ███
███ █████████████████
██ ██ ████████████
███
█████████████████████████ ██ █████████████████████████████████████
█████████████████ ██ ██

---

242 ██
██
██
██████████████████████████████
██ ██
██
██████████████████████
██ ███
██
█████████████████████
██ ██
██
██ ██
███
█████████████████
██ ███
██████████████████
██ ██
████████████████████████
██ ███
██
███
██
██
███

███

████████████

III.C. Google's Selective Application of Dynamic Sell-Side Fees Disadvantaged Rivals and Other Market Participants

138. Google's ad exchange, AdX, generates revenue by deducting a percentage, as a revenue share, from the payment it receives from buyers before forwarding the remainder to the publisher.[279] █

██

██████████████████████ ██ █████████████████████████████

██

██

139. Below in Section III.C.1, I begin by describing AdX's dynamic revenue sharing feature, its evolution over time, and its eventual phasing out in 2019. In Section III.C.2, I describe how AdX's sell-side dynamic revenue sharing feature allowed Google to win more auctions, particularly auctions for higher priced inventory, and further disadvantaged rival exchanges. Next, in Section III.C.3, I describe AdX's targeted implementation of its dynamic revenue sharing feature on non-Google demand sources, specifically excluding Google's DV360 and Google Ads. As discussed below, this Sell-Side DRS was important to AdX for converting its last look advantage into auction wins against rival exchanges and helped AdX build scale at its rivals' expense. Finally, in Section III.C.4, I describe how AdX's dynamic revenue sharing feature—in all its versions—were made effective by Google's existing scale and access to relevant auction data, such that it allowed Google to maintain its targeted average revenue-share.

---

[279]   *See* Lee Report, Section II.D.

█ ██

██

Moreover, Google ███
██████████████

194. ████████████████████████████████ ███ .[427]

III.D.3. Google's Bid Shading Projects Helped Delay AdX's Move to First-Price Auctions by Insulating AdX from Competition

195. It was not a coincidence that the rise of header bidding in 2017 coincided with the launch of Project Poirot. Given that publishers moved to header bidding, exchanges had strong incentives to move towards first-price auctions,[428] and many major exchanges had moved to the first-price format by 2017.[429] Indeed, the academic literature indicates that once exchanges begin competing simultaneously, as in the header-bidding setup, they have an incentive to move to first-price auctions.[430] However, once exchanges move to first-price auctions, exchanges lose

---

██ ██
██
██████████████████████████████████
██ ██
██

[428] Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 889 ("This move [towards first-price auctions] came about in a variety of ways, including the introduction of "soft floors" that were set by the ad exchanges. While the publisher supplied a reserve price with the request for bids, called the "hard floor," each ad exchange would set another, higher value as a soft floor and change the rule of the local auction in the following way: if there were at least two bids above the soft floor, they participated in a regular second-price auction; with only one bid above the soft floor, the soft floor then served as the clearing price; with all bids below the soft floor but some still above the hard floor, the bids participated in a first-price auction. Note that by setting the soft floor sufficiently high, the auction format is effectively converted from a second-price to a first-price auction. Indeed, several exchanges such as AppNexus advised advertisers to bid in soft-floor auctions just as they bid in first-price auctions (Gubbins 2017). The lack of transparency about the values of the soft floors set in these auctions led to such intermediate formats being quickly replaced by the more transparent first-price format with a reserve price").

[429] Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 889 ("Since its introduction, header bidding caught on very rapidly and became the mainstream format of publishers by the end of 2016…Before header bidding was introduced in the display advertising marketplace, the auction format for selling display ads was the well-established second-price format…However, in early 2017, right after the introduction of header bidding, several ad exchanges began experimenting with a first-price auction format instead.").

[430] Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 899 ("Under waterfalling, an exchange could use its position in the waterfall sequence to differentiate itself from other exchanges. When exchanges use second-price auctions, they can use their set of the advertisers to differentiate themselves from other exchanges…However, the combination of header bidding and first-price auctions puts exchanges in direct
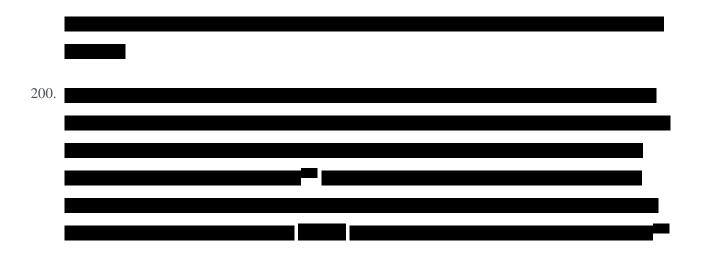
their differentiation since the ultimate winner is the highest bidder among all exchanges. As a result, competition among exchanges becomes fierce so that they likely engage in a "price war," cutting their fees significantly."[431]

196. Notably, it took two more years for Google's AdX to finally move to a first-price format, making it the last major exchange to do so.[432] This slow transition goes against the prediction of the academic literature that the economic forces in competitive markets would push exchanges to adopt the first-price auction format when they compete for the same impression head-to-head as in the header-bidding setup. During this over two-year period, instead of having AdX adopt the first-price auction format, Google used other means to dry up header bidding, including Poirot, as explained above.
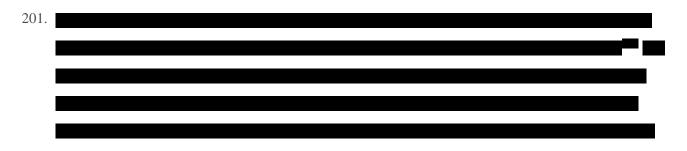
197. ███
███
██████ ███
███ █████ ████████████████
███

---

competition….[T]he move to first-price auction was necessary for an exchange to survive in the short run after the publishers adopted header bidding").

431   Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 899 ("While the move to first-price auction was necessary for an exchange to survive in the short run after the publishers adopted header bidding, after taking its effect on advertisers' choices of exchanges into account, our results show that the move will lower the exchanges' equilibrium buyer-side fees in the long run. This is consistent with several industry reports indicating a steep decline in exchange fees since the adoption of first-price auctions.").

432   Stylianos Despotakis, R. Ravi, and Amin Sayedi, "First-Price Auctions in Online Display Advertising," *Journal of Marketing Research* 58, no. 5 (2021): 888–907, at 889 ("After Google's move to first-price auctions in 2019, all major exchanges now use first-price auctions to sell display advertising impressions, when a publisher sends the request for bid to multiple exchanges."); *see also,* Jason Bigler, *"*An Update on First Price Auctions for Google Ad Manager," Google AdManager, May 10, 2019, https://blog.google/products/admanager/update-first-price-auctions-google-ad-manager/.

██ ███
███
██ ███
███
██ ██
███
███

██████ ██
████████████████████████████████ █████████████████████████████████ ██████
███ █████ ██████████████
██████████████████████████████████████ ███ ████████████████████████
███
████████████████████████████

198.   ███
██
███
████████████ ███ ███
██
██

199.   ██
██
███
██
██

██   ██
██
██
██   ██
██
████████████ ████████
██   ██
█████████████████ ███████
██   ██
██
██   ██
██████████████████████████████████ ████████
██   ███
███
████████████████

███

██████████

200. ██

███

███

███████████████████████████████ ██ ███████████████████████

███

██████████████████████████ █████ ████████████████████████████ ██

III.D.4. AdX Did Not Run Clean Second-Price Auctions Yet Google Did Not Decrease Bids on AdX

201. ███

███ ██ ██

██

██

███

██ ██
███
██
███
██
██
██████████████████████████████████

██ ██
███████████████

██ ███
███
████████

445 *See* Appendix F.1; ███
██
██
██
███████████████████████████████████

█████████ Taken together, Google designed its ad tech products for open web display advertising in ways that advantaged its own products while disadvantaging Google's rivals and Google's own customers (open web display publishers and advertisers).

Ramamoorthi Ravi, Ph.D.

December 22, 2023

Expert Report of R. Ravi (December 22, 2023)--Errata

Page	Paragraph	Footnote	Original	Corrected	Reason
7	6	.	"Nation Science Foundation (NSF)"	"National Science Foundation (NSF)"	Typo
14	14b	.	"First, an ad tech product that struggles to gain thickness on one side likely will have difficulty gaining thickness on the other side as well."	"First, an ad tech product that struggles to gain thickness on one side of the platform likely will have difficulty gaining thickness on the other side as well."	Clarification
19	24.a	31	Deepak Sharma, "DSP vs DMP: Differences, Similarities, and Their Hybrid Model," March 3, 2023	Deepak Sharma, "DSP vs DMP: Differences, Similarities, and Their Hybrid Model," AdPushup, March 3, 2023	Corrected Citation
20	25	38	Deposition of John Dederick (The Trade Desk), July 28, 2023, 98:2 – 98:22	Deposition of John Dederick (The Trade Desk), July 28, 2023, 97:25–98:22	Corrected Citation
23	Figure 2	.	...adapted from GOOG-DOJ-02427435, at -261.	...adapted from GOOG-DOJ-04601261, at -261.	Corrected Citation
23	30	53	("For publishers, this server-to-server setup means you are not constrained by the limitations of client-side ad code, and can integrate different ad formats.").	("Kevel is a fully featured ad server that can serve any creative and any ad format").	Corrected Citation
53	91	184	$0.85 * \$0.64 = \$0.55.$	$0.86 * \$0.64 = \$0.55.$	Typo
70	125	248	GOOG-DOJ-03901693, at -704 and -709	GOOG-DOJ-03901693, at -704	Corrected Citation
70	126	███	██	██ "	Corrected Citation
82	151	304	GOOG-DOJ-13227256, at -256	GOOG-DOJ-13227256, at -260	Corrected Citation
88	162	338	GOOG-AT-MDL-004061913, at -914	GOOG-AT-MDL-004061913, at -915	Corrected Citation
91	170	352	GOOG-DOJ-11728951, at -945	GOOG-DOJ-11728951, at -954	Corrected Citation
101	189	407	GOOG-DOJ-AT-02635025 at -027	GOOG-DOJ-AT-02635025, at -027 (08/19/2018) ████████████████████	Corrected Citation
105	196	432	Jason Bigler…-google-ad-manager/.	Jason Bigler…-google-ad-manager/ ("May 10, 2019…Google Ad Manager will be transitioning to a unified, first price auction this year.").	Corrected Citation
110	205	457	GOOG-DOJ-13204676, at -676–77	GOOG-DOJ-13204676, at -676	Corrected Citation

Expert Report of R. Ravi (December 22, 2023)--Errata

Page	Paragraph	Footnote	Original	Corrected	Reason
117	219	504	...September 5, 2019, https:…partners/.	...September 5, 2019, https:…partners/ ("As we announced in March, we're transitioning to unified first price auctions for Google Ad Manager").	Corrected Citation
██	██	██	███████████████	███████████████	██
181	Appendix B	[183]	GOOG-DOJ-AT-00621759	GOOG-DOJ-AT-006217592	Typo
181	Appendix B	[209]	GOOG-AT-MDL-01168711	GOOG-AT-MDL-011687119	Typo
182	Appendix B	[283]	GOOG-DOJ-11726039	GOOG-DOJ-11726308	Typo
187	268c	.	"This value CPM is the historical average CPM delivered by each SSP/Exchange for that line item."	"This value CPM could be the historical average CPM delivered by each SSP/Exchange for that line item."	Correction
██	██	██	███████████████	███████████████	██

Expert Report of R. Ravi (December 22, 2023)--Errata

Page	Paragraph	Footnote	Original	Corrected	Reason
■	■	■	█████████████	████████████	■
■	■	████████████	█████████████		■
■	■	██████████████	██████████████		
217	314	754	"google-ads/answer/7065882."	"google-ads/answer/7065882 ("Smart Bidding refers to bid strategies that use Google AI to optimize for conversions or conversion value in each and every auction…Target CPA, Target ROAS, Maximize conversions, and Maximize conversion value are all Smart Bidding strategies.")."	Corrected Citation
220	321	770	GOOG-AT-MDL-009709715, at -103	GOOG-AT-MDL-009709715, at -716	Corrected Citation
220	321	771	GOOG-AT-MDL-009709715, at -103	GOOG-AT-MDL-009709715, at -716	Corrected Citation
■	■	███████████	████████	■
■	■	█████████████	█████████████	████
■	■	██████████████	████████████	■
238	353	878	GOOG-DOJ-AT-02434618	GOOG-DOJ-AT-02434618, at -618	Corrected Citation
240	357	894	GOOG-DOJ-AT-02512863	GOOG-DOJ-AT-02512863, at -864	Corrected Citation
254	Fig. 18	[9]	GOOG-DOJ-AT-02242745	GOOG-DOJ-AT-02242745, at -745–746	Corrected Citation

R. Ravi